Oxygen isotopes in 4.37-3.8 Ga zircons indicate the presence of a hydrosphere in the Hadean.

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Hadean (4.5 – 4.0 Ga) zircons are rare, but without a preserved Hadean rock record, they are the only tangible resource available to answer questions regarding the habitability of Earth ≥ 4.0 Ga. Core regions of 4.37-3.8 Ga zircons with igneous compositions are enriched in ^{18}O and contain metaluminous and peraluminous mineral inclusions, both features indicative of S-type grainitod protoliths.

We have collected _^{18}O$_{SMOW}$ data from forty 4.0 - 3.8 Ga and fifty-five ≥4.0 Ga >90% concordant detrital zircons from Jack Hills, Western Australia on the UCLA Cameca ims1270 ion microprobe in multicollector mode. Zircons with multiple age analyses have correlative O isotope spots. For all analyses, cracks and metamict areas were avoided and retrospective imaging was used to reject problematic data. We corrected for instrumental mass fractionation with standards KIM-5 _^{18}O = 5.09‰ (Valley 2003) and 91500 _^{18}O = 9.86‰ (Weidenbeck et al. 2004). Oxygen isotope data show that the rock cycle evolved early, before *ca*. 4.37 Ga; _^{18}O zircon values are as high as +10‰ (much higher than average mantle values) and estimates of _^{18}O$_{WR}$ are as high as +12‰.

These zircons were not derived exclusively from a TTG-type protolith, but instead included some portion of reworked crust in the presence of liquid water. Study of these ancient zircons provides a unique window into the first half billion years that permits assessment of the potential of the Hadean Earth to host an emergent biosphere. These data are consistent with previous reports and demonstrate the appearance and survival of a hydrosphere 4.37 – 3.8 Ga and beyond.